Kramer Electronics, Ltd.

USER MANUAL

Model:

VS-161HDMI

16x1 HDMI Switcher

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1 Introduction

Welcome to Kramer Electronics (since 1981): a world of unique, creative and affordable solutions to the infinite range of problems that confront the video, audio and presentation professional on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better! Our 500-plus different models now appear in 8 Groups[1], which are clearly defined by function.

Congratulations on purchasing your Kramer **VS-161HDMI** *16x1 HDMI Switcher*.

The **VS-161HDMI** is ideal for conference room presentations and advertising applications, as well as for rental and staging.

Each package includes the following items:

- **VS-161HDMI** *16x1 HDMI Switcher*
- Power cord and Null-modem adapter
- Windows®-based Kramer control software[2]
- Windows®-based Ethernet Configuration Manager and Virtual Serial Port Manager
- Kramer **RC-IR1** Infra-Red Remote Control Transmitter[3] (including the required batteries and a separate user manual[4])
- This user manual[4]

2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual
- Use Kramer high performance high resolution cables[5]

2.1 Quick Start

This quick start chart summarizes the basic setup and operation steps.

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1 GROUP 1: Distribution Amplifiers; GROUP 2: Video and Audio Switchers, Matrix Switchers and Controllers; GROUP 3: Video, Audio, VGA/XGA Processors; GROUP 4: Interfaces and Sync Processors; GROUP 5: Twisted Pair Interfaces; GROUP 6: Accessories and Rack Adapters; GROUP 7: Scan Converters and Scalers; and GROUP 8: Cables and Connectors

2 Downloadable from our Web site at http://www.kramerelectronics.com

3 Previously known as the IR-1 / IR-1-01

4 Download up-to-date Kramer user manuals from our Web site at http://www.kramerelectronics.com

5 The complete list of Kramer cables is on our Web site at http://www.kramerelectronics.com

Step 1: Mount the machine - see section 5

Mount the machine in a rack or stick the 4 rubber feet to the underside
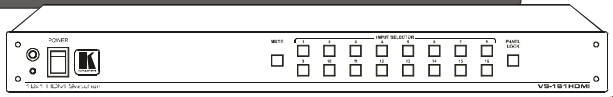
Step 2: Connect the inputs, output and controller- see section 6

Connect the inputs and the output

Connect a PC or a controller via RS-232 or the ETHERNET to control the VS-161HDMI

Step 3: Turn the power ON

Step 4: Set the machine - see section 7

ACQUIRE EDID

Connect the output to acquire the EDID or disconnect the output to set to the default EDID

● Turn the power OFF
● Press the PANEL LOCK button and the INPUT 16 button while turning the power ON
● WAIT for the input buttons to stop blinking in sequence

Output connected

Acquired EDID

OUTPUT
Output not connected

Default EDID
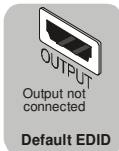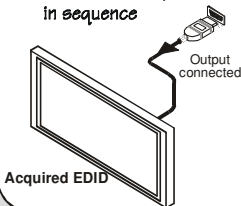
SET TO PC MODE OR DVD MODE:

PC Mode - a PC is connected to an input
DVD mode - a DVD is connected to an input

● Turn the power OFF
● Press the PANEL LOCK button while turning the power ON
● Hold the PANEL LOCK button for a few seconds and then release and check the INPUT button's status:
In the DVD mode, the INPUT button illuminates
In the PC mode, the INPUT button does not illuminate
● Press an input button to toggle between the PC and DVD modes

To input

PC Mode

To input

DVD Mode
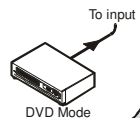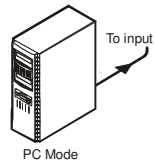
Step 5: Operate the machine

Operate via the front panel buttons, IR remote control, RS-232, and ETHERNET

3 Overview

The **VS-161HDMI** is a high quality 16x1 switcher for HDMI signals.

In particular, the **VS-161HDMI**:

- Supports up to 1.65Gbps bandwidth per graphic channel[1]
- Has sixteen input selector buttons
- Supports HDCP (High Definition Digital Content Protection)
- Includes a MUTE button to disconnect the output and a PANEL LOCK button to prevent unwanted tampering with the buttons on the front panel
- Fits in one vertical space of a standard 19" professional rack enclosure

Control the **VS-161HDMI** using the front panel buttons, or remotely via:

- RS-232 serial commands transmitted by a touch screen system, PC, or other serial controller
- The Kramer infra-red remote control transmitter
- The ETHERNET

3.1 Defining EDID

The Extended Display Identification Data (EDID[2]) is a data-structure, provided by a display, to describe its capabilities to an HDMI source. The EDID enables the **VS-161HDMI** to "know" what kind of monitor is connected to the output. The EDID includes the manufacturer's name, the product type, the timing data supported by the display, the display size, luminance data and (for digital displays only) the pixel mapping data.

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1 Suitable for resolutions up to UXGA at 60Hz, and for all HD resolutions

2 Defined by a standard published by the Video Electronics Standards Association (VESA)

3.2 About HDMI

High-Definition Multimedia Interface (HDMI) is an uncompressed all-digital[1] audio/video interface, widely supported in the entertainment and home cinema industry. It delivers the highest high-definition image and sound quality. Note that Kramer Electronics Limited is an HDMI Adopter[2] and an HDCP Licensee[3].

In particular, HDMI:

- Provides a simple[4] interface between any audio/video source, such as a set-top box, DVD player, or A/V receiver and video monitor, such as a digital flat LCD / plasma television (DTV), over a single lengthy[5] cable
- Supports standard, enhanced, high-definition video, and multi-channel digital audio[6] on a single cable
- Transmits all ATSC HDTV standards and supports 8-channel digital audio, with bandwidth to spare to accommodate future enhancements and requirements
- Benefits consumers by providing superior, uncompressed digital video quality via a single cable[7], and user-friendly connector
- Is backward-compatible with DVI (Digital Visual Interface)
- Supports two-way communication between the video source (such as a DVD player) and the digital television, enabling new functionality such as automatic configuration and one-button play

HDMI has the capacity to support existing high-definition video formats (720p, 1080i, and 1080p/60), standard definition formats such as NTSC or PAL, as well as 480p and 576p.

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1 Ensuring an all-digital rendering of video without the losses associated with analog interfaces and their unnecessary digital-to-analog conversions

2 See http://www.hdmi.org/about/adopters_founders.asp

3 See http://www.digital-cp.com/list/

4 With video and multi-channel audio combined into a single cable, the cost, complexity, and confusion of multiple cables currently used in A/V systems is reduced

5 HDMI technology has been designed to use standard copper cable construction at up to 15m

6 HDMI supports multiple audio formats, from standard stereo to multi-channel surround-sound. HDMI has the capacity to support Dolby 5.1 audio and high-resolution audio formats

7 HDMI provides the quality and functionality of a digital interface while also supporting uncompressed video formats in a simple, cost-effective manner

3.3 Recommendations for Best Performance

To achieve the best performance:

- Connect only good quality connection cables, thus avoiding interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)

- Avoid interference from neighboring electrical appliances and position your **VS-161HDMI** away from moisture, excessive sunlight and dust

3.4 Terminology Used in this User Manual

Table 1 defines some terms that are used in this user manual.

Table 1: Terminology Used in this User Manual

Term	Definition
802.3	The standard specification for ETHERNET that is maintained by the Institute of Electrical and Electronics Engineers (IEEE).
Dynamic Host Configuration Protocol (DHCP)	Allows the network administrator to distribute IP addresses from a central point and automatically send a new IP address when an Ethernet point is plugged into a different network location.
Gateway	A network position serving as an entry to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node.
IP Address	A 32-binary digit number that identifies each sender or receiver (within a network via a particular server or workstation) of data (HTML pages or e-mails) that is sent in packets across the Internet. Every device connected to an IP network must have a unique IP address. This address is used to reference the specific unit.
Local Area Network (LAN)	Computers sharing a common communications line or wireless link, which often share a server within a defined geographic area.
Media Access Control (MAC) Address	A computer's unique hardware number (or address) in a LAN or other network. On an Ethernet LAN, the (MAC) address is identical to the Ethernet address.
Transmission Control Protocol/Internet Protocol (TCP/IP)	The basic communication language or protocol of the Internet that breaks the message into appropriately sized packets for the network, and can be used as a communications protocol in an intranet or an extranet.

4 Your VS-161HDMI 16x1 Switcher

Figure 1 illustrates the front and rear panels of the **VS-161HDMI**. Table 2 and Table 3 define the front and rear panels of the **VS-161HDMI**, respectively.
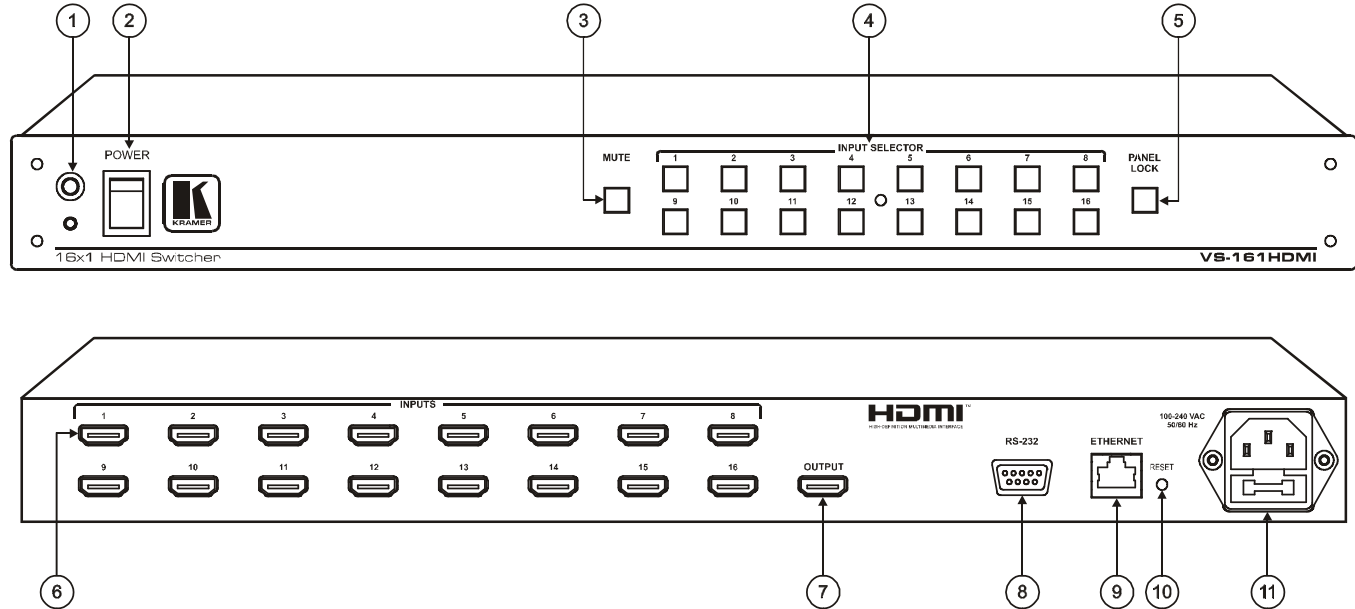
Figure 1: VS-161HDMI 16x1 HDMI Switcher

Table 2: VS-161HDMI 16x1 HDMI Switcher Front Panel Features

#	Feature	Function
1	IR Receiver	The red LED lights when receiving signals from the Infra-red remote control transmitter
2	*POWER* Switch	Illuminated switch for turning the unit ON or OFF
3	*MUTE* Button	Press to toggle disconnecting the output
4	*INPUT SELECTOR* Buttons	Press the INPUT button to select input (from 1 to 16)
5	*PANEL LOCK Button*	Press to toggle disengaging the front panel buttons, to acquire the EDID and to set to the PC/DVD mode

Table 3: VS-161HDMI 16x1 HDMI Switcher Rear Panel Features

#	Feature	Function
6	*INPUT* HDMI Connectors	Connect to the HDMI sources (from 1 to 16)
7	*OUTPUT* HDMI Connector	Connect to the HDMI acceptor
8	*RS-232* DB 9F Port	Connects to the PC or the RS-232 Remote Controller
9	*ETHERNET* Connector	Connects to the PC or other Ethernet Controller
10	*RESET* Button	Press the ETHERNET factory reset button to reset to the factory default definitions[1]: IP number – 192.168.1.39 Mask – 255.255.255.0 Gateway – 192.168.1.1
11	Power Connector with Fuse	AC connector enabling power supply to the unit

[1] First, disconnect the power cord and then connect it again while pressing the RESET button. The unit will power up and load its memory with the factory default definitions

5 Installing the VS-161HDMI on a Rack

This section describes what to do before installing on a rack and how to rack mount.

Before Installing on a Rack

Before installing on a rack, be sure that the environment is within the recommended range:

|	
Operating temperature range	+5 to +45 Deg. Centigrade
Operating humidity range	5 to 65 % RHL, non-condensing
Storage temperature range	-20 to +70 Deg. Centigrade
Storage humidity range	5 to 95% RHL, non-condensing

⚠ **CAUTION!!**

When installing on a 19" rack, avoid hazards by taking care that:

1 It is located within the recommended environmental conditions, as the operating ambient temperature of a closed or multi unit rack assembly may exceed the room ambient temperature.

2 Once rack mounted, enough air will still flow around the machine.

3 The machine is placed straight in the correct horizontal position.

4 You do not overload the circuit(s). When connecting the machine to the supply circuit, overloading the circuits might have a detrimental effect on overcurrent protection and supply wiring. Refer to the appropriate nameplate ratings for information. For example, for fuse replacement, see the value printed on the product label.

5 The machine is earthed (grounded) in a reliable way and is connected only to an electricity socket with grounding. Pay particular attention to supply connections other than direct connections to the branch circuit (for example, the use of power strips), and that you use only the power cord that is supplied with the machine.

How to Rack Mount

To rack-mount the machine:

1 Attach both ear brackets to the machine. To do so, remove the screws from each side of the machine (3 on each side), and replace those screws through the ear brackets.
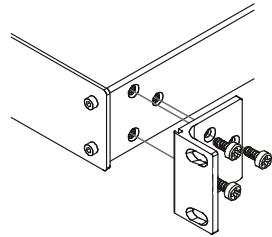
2 Place the ears of the machine against the rack rails, and insert the proper screws (not provided) through each of the four holes in the rack ears.

Note that:

• In some models, the front panel may feature built-in rack ears

• Detachable rack ears can be removed for desktop use

• Always mount the machine in the rack before you attach any cables or connect the machine to the power

• If you are using a Kramer rack adapter kit (for a machine that is not 19"), see the Rack Adapters user manual for installation instructions (you can download it at: http://www.kramerelectronics.com)

6   Connecting a VS-161HDMI 16x1 HDMI Switcher

To connect the **VS-161HDMI** *16x1 HDMI Switcher* as illustrated in the example in Figure 2, do the following[1]:

1. If required:
    - Set the appropriate INPUTS to the DVD/PC mode (see section 7.1)
    - Acquire the EDID (see section 7.2)

2. Connect[2] the HDMI sources as follows[3]:
    - A multimedia player to INPUT 1
    - A set top box to INPUT 2
    - A DVD player to INPUT 6
    - A DVD player to INPUT 16

3. Connect the OUTPUT HDMI connector to an HDMI acceptor (for example, a plasma display).

4. If required, connect a PC and/or controller to the RS-232 port (see section 7.3) and/or the ETHERNET port (see section 7.4).

5. Connect the power connector to the mains electricity.

Press an INPUT SELECTOR button (from 1 to 16) to choose which HDMI input to route to the output[4].

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1 Switch OFF the power on each device before connecting it to your VS-161HDMI. After connecting your VS-161HDMI, switch on its power and then switch on the power on each device

2 You can connect up to 16 HDMI sources

3 Alternatively, you can connect a PC to any of the inputs and set those inputs to the PC mode (see section 7.1)

4 The input button illuminates
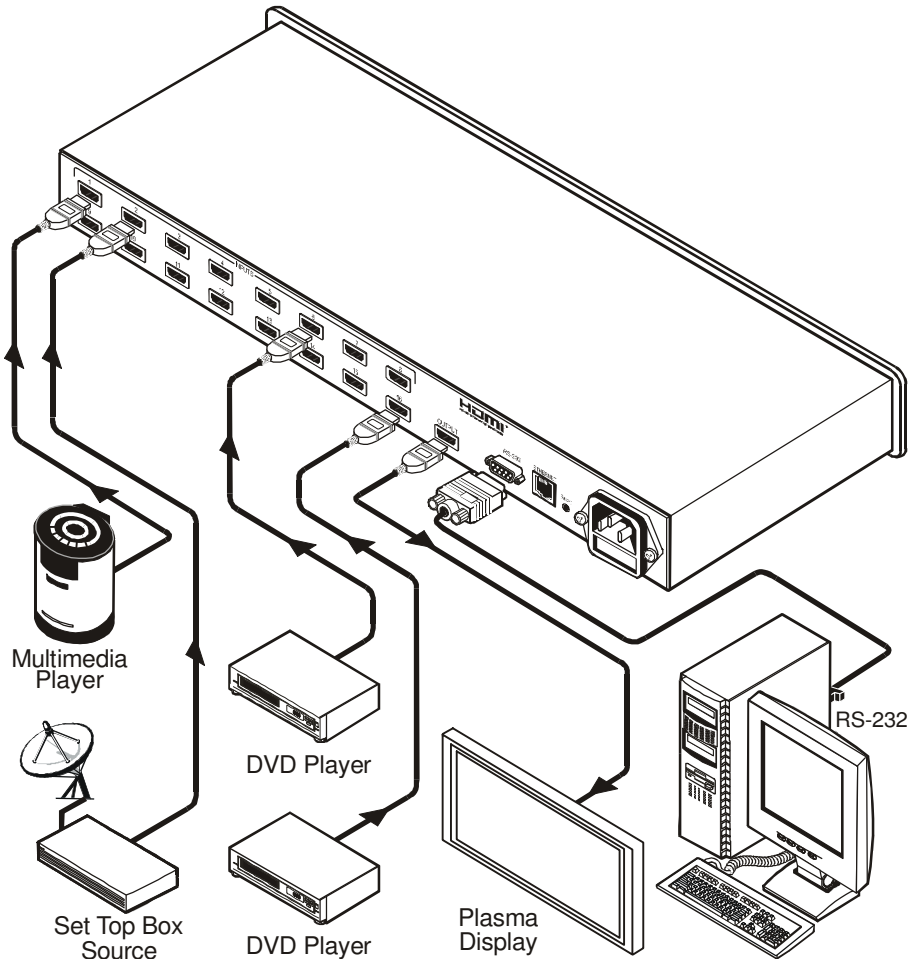
Figure 2: Connecting a VS-161HDMI 16x1 HDMI Switcher

7 Operating the VS-161HDMI

This section describes:

- The PC mode and the DVD mode (see section 7.1)
- How to acquire the EDID (see section 7.2)
- How to control the machine via RS-232 (see section 7.3)
- How to control the machine via the ETHERNET port (see section 7.4)

7.1 The PC and DVD Modes

The **VS-161HDMI** has two operation modes that are specific per input: the PC mode[1] and the DVD mode:

- The PC mode is used when connecting a computer or several computers to one or more of the inputs via a DVI-to-HDMI converter cable[2]
- The DVD mode is used when connecting a DVD or several DVDs to the inputs

When in the PC mode, the input has access to the EDID (default or acquired) to prevent the computer from resetting if an output is not connected. In the DVD mode, the EDID of the connected output is available only when the input to which the DVD is connected, is switched to the output.

The PC mode and the DVD mode can be applied to a single input or to several inputs. For example, if you want to connect a computer to INPUT 1, another computer to INPUT 2, and DVD machines to all the other inputs (from INPUT 3 to INPUT 16), set INPUT 1 and INPUT 2 to the PC mode and all the other inputs to the DVD mode.

To set the inputs to either the PC or the DVD mode, do the following:

1. Turn the POWER off.
2. Press the PANEL LOCK button while turning the POWER on again. The INPUT buttons blink simultaneously.
3. Keep pressing and holding the PANEL LOCK button for a few seconds and then release it.
   The PANEL LOCK button blinks.
   If an input button illuminates, this indicates that that input is set to the DVD mode.
   If an input button is not illuminated, this indicates that that input is set to the PC mode.

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1 The default

2 For example, the Kramer HDMI-DVI Gold Plated Cable in various lengths (3", 6", 10" and 15")

4. Toggle between the PC mode (input button not illuminated) and the DVD mode (input button illuminated) by pressing that input.

5. Press the PANEL LOCK button to exit this mode.

6. You can connect a computer to the input(s) that is set to the PC mode and a DVD to the input(s) that is set to the DVD mode.

Table 4 summarizes the differences between the PC mode and the DVD mode:

Table 4: DVD Mode and PC Mode Characteristics

PC Mode	DVD Mode
The input is connected to a computer	The input is connected to a multimedia application, such as a DVD, a set top box and so on
The EDID is available at all times (to prevent computer reset)	The EDID is available only when that input is connected to an output
The input EDID source is the default EDID or an acquired EDID (see section 7.2)	The input EDID source is acquired directly from the connected output

7.2 Acquiring the EDID

The acquired EDID is used when an input is set to the PC mode.

To acquire the EDID, do the following:

1. Turn the POWER off.

2. Press the PANEL LOCK button and the INPUT 16 button while turning the POWER on again.
   The INPUT buttons blink in sequence until the unit has completed to read the EDID.

3. Release the PANEL LOCK and INPUT 16 buttons.

If an output was connected, the output EDID is read to all the inputs. If an output was not connected to the machine, the default EDID is read to the inputs.

7.3 Controlling via RS-232 (for example, using a PC)

To connect a PC to the **VS-161HDMI** unit, using the Null-modem adapter provided *with* the machine (recommended):

- Connect the RS-232 DB9 rear panel port on the **VS-161HDMI** unit to the Null-modem adapter and connect the Null-modem adapter with a 9-wire flat cable to the RS-232 DB9 port on your PC

To connect a PC to the **VS-161HDMI** unit, *without* using a Null-modem adapter:

- Connect the RS-232 DB9 port on your PC to the RS-232 DB9 rear panel port on the Master **VS-161HDMI** unit, as Figure 3 illustrates
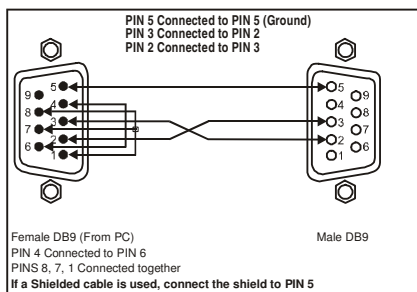

Figure 3: Connecting a PC without using a Null-modem Adapter

7.4 Controlling the VS-161HDMI via the ETHERNET Port

You can connect the **VS-161HDMI** via the Ethernet, using a crossover cable (see section 7.4.1) for direct connection to the PC or a straight through cable (see section 7.4.2) for connection via a network hub or network router.

7.4.1 Connecting the ETHERNET Port directly to a PC (Crossover Cable)

You can connect the Ethernet port of the **VS-161HDMI** to the Ethernet port on your PC, via a crossover cable with RJ-45 connectors, as Table 5 and Figure 4 define.

Figure 4: RJ-45 PINOUT

Table 5: Crossover Cable RJ-45 PINOUT

EIA /TIA 568A Side 1		EIA /TIA 568B Side 2	
PIN	Wire Color	PIN	Wire Color
1	White-orange	1	White-green
2	Orange	2	Green
3	White-green	3	White-orange
4	Blue	4	Blue
5	White-blue	5	White-blue
6	Green	6	Orange
7	White-brown	7	White-brown
8	Brown	8	Brown
Pair 1	4 and 5	Pair 1	4 and 5
Pair 2	1 and 2	Pair 2	3 and 6
Pair 3	3 and 6	Pair 3	1 and 2
Pair 4	7 and 8	Pair 4	7 and 8
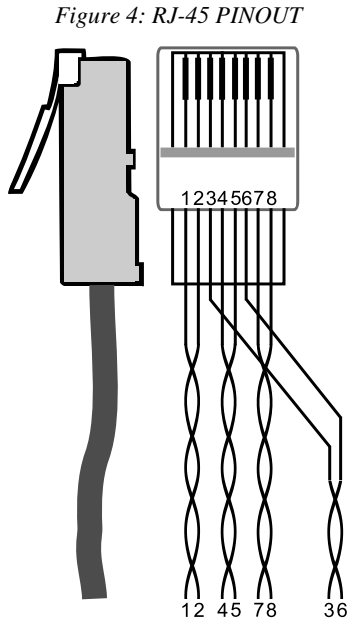
This type of connection is recommended for identification of the factory default IP Address of the **VS-161HDMI** during the initial configuration

After connecting the Ethernet port, configure your PC as follows:

1. Right-click the My Network Places icon on your desktop.
2. Select **Properties**.
3. Right-click Local Area Connection Properties.
4. Select **Properties**.
   The Local Area Connection Properties window appears.

5. Select the Internet Protocol (TCP/IP) and click the **Properties** Button (see Figure 5).
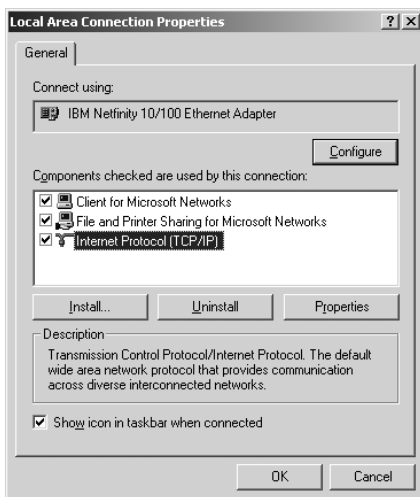

Figure 5: Local Area Connection Properties Window

6. Select Use the following IP Address, and fill in the details as shown in Figure 6.

7. Click **OK**.
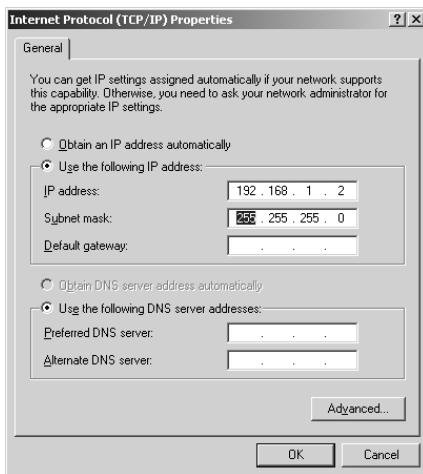
Figure 6: Internet Protocol (TCP/IP) Properties Window

7.4.2 Connecting the ETHERNET Port via a Network Hub (Straight-Through Cable)

You can connect the Ethernet port of the **VS-161HDMI** to the Ethernet port on a network hub or network router, via a straight-through cable with RJ-45 connectors, as Table 6 defines:

Table 6: Straight-through Cable RJ-45 PINOUT

Side 1		Side 2	
PIN	Wire Color	PIN	Wire Color
1	White-orange	1	White-orange
2	Orange	2	Orange
3	White-green	3	White-green
4	Blue	4	Blue
5	White-blue	5	White-blue
6	Green	6	Green
7	White-brown	7	White-brown
8	Brown	8	Brown

7.5 Configuring the Ethernet Port

To configure the ETHERNET port, do the following:

1. Connect the ETHERNET port as described in section 7.4.1.

2. Insert the CD-ROM in the CD-ROM drive, double click the Set *Setfc11eth_confxx.exe*[1] file and follow the on-screen instructions[2]. The Ethernet Configuration Manager is installed.

3. Click the appropriate shortcut in the Start menu's Programs folder. The Configuration Manager window (see Figure 7) opens.

4. Click the Search button[3] (or the Action menu's, Search Board command). The MAC Address for the found ETHERNET port appears in the Device List.

5. Change the settings according to your network requirements and then click the Config button (or the Action menu's, Config command) to apply the settings.

> Note, that clicking the Config button will alter the IP settings of the ETHERNET port

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1 File names are liable to change from time to time

2 The latest version appears on our Web site at http://www.kramerelectronics.com

3 To automatically search for devices
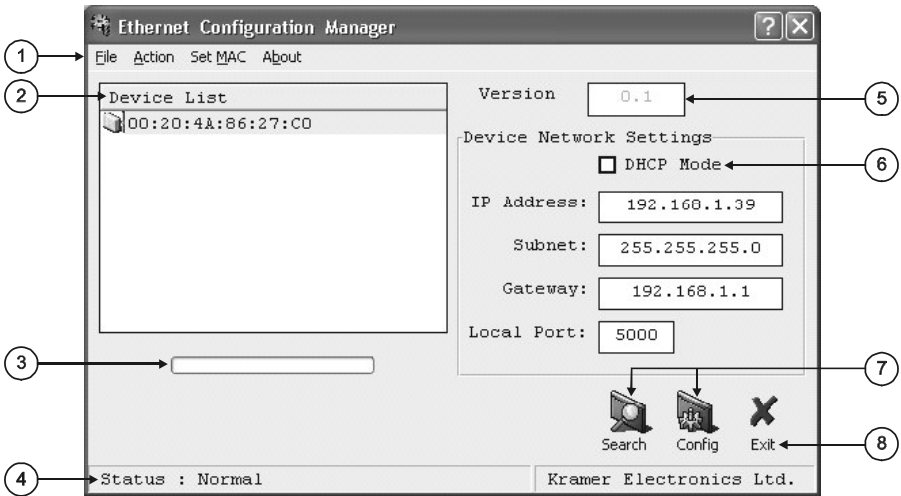
Figure 7: The Ethernet Configuration Manager Window

Table 7: Ethernet Configuration Manager Window Functionality

#	Feature		Function
1	Menu bar	File	The *Exit* command closes the Configuration Manager application
		Action	The *Search Board* command seeks the **VS-161HDMI** device that connects to the PC via the ETHERNET port, and displays it and its corresponding settings; The *Config* command adjusts the **VS-161HDMI** according to the displayed data
		Set MAC[1]	For factory use only (click the *Password* command to enter the password)
		About	Displays software information, including the software version
2	Device List		Displays the MAC Address
3	Progress Bar		Shows the progress
4	Status Bar		Shows the status
5	Version		Displays the firmware version
6	Device Network Settings Area		**DHCP[1] Mode** Check Box: When selected, configures the Ethernet port to obtain an IP address automatically from the DHCP server. When cleared, manual configuration of the Ethernet port is required to obtain an IP address (Static IP) **IP Address**: A 32-binary digit number obtained from your Network Administrator that identifies the Ethernet port that is currently being configured **Subnet**: A 32-binary digit number obtained from your Network Administrator, which combined with the IP Address, identifies which network your device is on **Gateway**: A network position serving as an entry to another network or to the Internet (only relevant in the Active Routing mode)
7	Action Buttons		**Search**: seeks the devices that connect to the PC via the ETHERNET port, and displays them and their corresponding settings **Config**: adjusts the according to the displayed data
8	Exit Button		Closes the Configuration Manager application

1 See the definition in Table 1

7.5.1 Setting a Virtual Port

If the control application cannot work with an Ethernet driver, use the Kramer Virtual port driver as follows:

1. Insert the CD-ROM in the CD-ROM drive, double click the *SetKVSP_xx.exe*[1] file and follow the on-screen instructions[2].
   The virtual serial port is installed.

2. Run the Virtual Serial Port Manager Application.
   The Virtual Serial Port Manager window appears (see Figure 8).
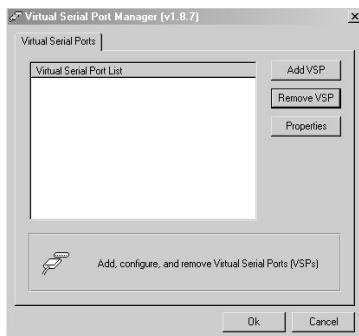
Figure 8: The Virtual Serial Port Manager Window

3. Press the **Add VSP** button to add a serial port and type the IP settings according to the IP address and local port of your **VS-161HDMI** (see Figure 9).
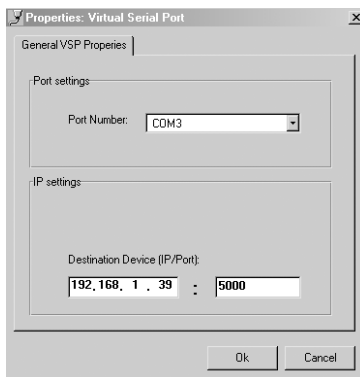
Figure 9: The Virtual Serial Port Properties Window

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1 File names are liable to change from time to time

2 The latest version appears on our Web site at http://www.kramerelectronics.com

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4. You can set a virtual port for each local port on your **VS-161HDMI** (see Figure 10).
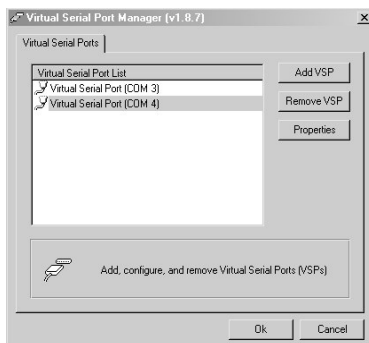
Figure 10: The Virtual Serial Port Properties Window (COM 3 and COM 4)

5. In the control application, choose the COM-port connection according to your virtual serial port connections (see Figure 11).
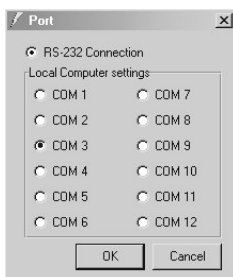
Figure 11: The Port Window – Selecting a Virtual Serial Port

7.5.2 Setting an Ethernet Connection

If the control application can connect directly to the Ethernet driver, select the host IP and port number, as illustrated in Figure 12.
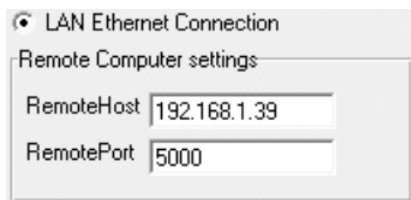
Figure 12: The Port Window – Selecting a Remote Connection

8   Technical Specifications

Table 8 includes the technical specifications:

Table 8: Technical Specifications[1] of the VS-161HDMI

INPUTS:	16 HDMI Connectors
OUTPUT:	1 HDMI Connector
BANDWIDTH:	Supports up to 1.65Gbps bandwidth per graphic channel
COMPLIANCE WITH HDMI STANDARD:	Supports HDMI 1.2 and HDCP
RESOLUTION:	Up to UXGA; 1080p
POWER SOURCE:	90–240VAC; 50/60Hz, 22VA
CONTROLS:	Front panel buttons, Infra-red remote control transmitter, RS-232, Ethernet
DIMENSIONS:	19-inch (W), 7-inch (D), 1U (H)
WEIGHT:	2.5 kg. (5.5 lbs.) approx.
ACCESSORIES:	Power cord
OPTIONS:	Kramer HDMI cables[2]

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1 Specifications are subject to change without notice

2 For best results, use Kramer cables such as the C-HDMI/HDMI series, the C-HDMI-DVI series and/or our HDMI over fiber optics C-FOHM/FOHM series

9 Kramer Protocol 2000[1]

The **VS-161HDMI** is compatible with Kramer's Protocol 2000 (version 0.46) (below). This RS-232/RS-485 communication protocol uses four bytes of information as defined below. For RS-232, a null-modem connection between the machine and controller is used. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

Table 9: Protocol Definitions

MSB							LSB
	DESTI-NATION	INSTRUCTION					
0	D	N5	N4	N3	N2	N1	N0
7	6	5	4	3	2	1	0

1st byte

	INPUT						
1	I6	I5	I4	I3	I2	I1	I0
7	6	5	4	3	2	1	0

2nd byte

	OUTPUT						
1	O6	O5	O4	O3	O2	O1	O0
7	6	5	4	3	2	1	0

3rd byte

			MACHINE NUMBER				
1	OVR	X	M4	M3	M2	M1	M0
7	6	5	4	3	2	1	0

4th byte

1st BYTE: Bit 7 – Defined as 0.
D – "DESTINATION":   0 - for sending information to the switchers (from the PC);
1 - for sending to the PC (from the switcher).
N5…N0 – "INSTRUCTION"
The function that is to be performed by the switcher(s) is defined by the INSTRUCTION (6 bits). Similarly, if a function is performed via the machine's keyboard, then these bits are set with the INSTRUCTION NO., which was performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value to be set for N5…N0).

2nd BYTE: Bit 7 – Defined as 1.
                         I6…I0 – "INPUT".
When switching (ie. instruction codes 1 and 2), the INPUT (7 bits) is set as the input number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the INPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

3rd BYTE: Bit 7 – Defined as 1.
                         O6…O0 – "OUTPUT".
When switching (ie. instruction codes 1 and 2), the OUTPUT (7 bits) is set as the output number which is to be switched. Similarly, if switching is done via the machine's front-panel, then these bits are set with the OUTPUT NUMBER which was switched. For other operations, these bits are defined according to the table.

4th BYTE: Bit 7 – Defined as 1.
              Bit 5 – Don't care.
              OVR – Machine number override.
              M4…M0 – MACHINE NUMBER.
Used to address machines in a system via their machine numbers. When several machines are controlled from a single serial port, they are usually configured together with each machine having an individual machine number. If the OVR bit is set, then all machine numbers will accept (implement) the command, and the addressed machine will reply.

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1 You can download our user-friendly "Software for Calculating Hex Codes for Protocol 2000" from our Web site: http://www.kramerelectronics.com

For a single machine controlled via the serial port, always set M4…M0 = 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

Table 10: Instruction Codes for Protocol 2000

Note: All values in the table are decimal, unless otherwise stated.

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
0	RESET VIDEO	0	0	1
1	SWITCH VIDEO	Set equal to video input which is to be switched (0 = disconnect)	Set equal to video output which is to be switched (0 = to all the outputs)	2, 15
2	SWITCH AUDIO	Set equal to audio input which is to be switched (0 = disconnect)	Set equal to audio output which is to be switched (0 = to all the outputs)	2
3	STORE VIDEO STATUS	Set as SETUP #	0 - to store 1 - to delete	2, 3, 15
4	RECALL VIDEO STATUS	Set as SETUP #	0	2, 3, 15
5	REQUEST STATUS OF A VIDEO OUTPUT	Set as SETUP #	Equal to output number whose status is reqd	4, 3
6	REQUEST STATUS OF AN AUDIO OUTPUT	Set as SETUP #	Equal to output number whose status is reqd	4, 3
7	VIS SOURCE	Set as input # when OUTPUT byte = 6; OR set as output # when OUTPUT byte = 7; OR set as blank period (in steps of 25ms) when OUTPUT byte = 32; OR set = 0. *****	0 - No VIS (immediate) 1 - Input # 1 2 - External digital sync 3 - External analog sync 4 - Dynamic sync 5 - Inter-machine sync 6 - Input # (INPUT byte) 7 - Output #(INPUT byte) 8 - User-defined sync 32 - RGBHV seamless switching 64 - Set for delayed switch 65 - Execute delayed switch 66 - Cancel delayed switch setting	2, 5, 17, 18
8	BREAKAWAY SETTING	0	0 - audio-follow-video 1 - audio breakaway	2
		1	0 - FOLLOW mode 1 - Normal mode	15
9	VIDEO / AUDIO TYPE SETTING	0 - for video	0 - CV 4 - SDI 1 - YC 5 - CV+YC 2 - YUV 6 - VGA scaler 3 - RGBS 7 - DVI	2
		1 - for audio	O0=0 – Unbalanced audio O0=1 – Balanced audio O1=0 – Digital audio O1=1 – Analog audio O4=0, O3=0, O2=0-Mono O4=0, O3=0,O2=1-Stereo	
		2 - for VGA and DVI	1 - 640X480 2 - 800X600 3 - 1024X768	
10	REQUEST VIS SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - VIS source 1 - Input # or output # of source 2 - Vertical sync freq (Hz)	3, 4, 6, 7
11	REQUEST BREAKAWAY SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - Request audio breakaway setting 1 - Request "FOLLOW" setting	3, 4, 6, 15
12	REQUEST VIDEO / AUDIO TYPE SETTING	Set as SETUP #, or set to 126 or 127 to request if machine has this function	0 - for video 1 - for audio 2 - for VGA	3, 4, 6
13	SET HIGHEST MACHINE ADDRESS	0 - for video 1 - for audio	Set equal to highest machine address	2
14	REQUEST HIGHEST MACHINE ADDRESS	0 - for video 1 - for audio	0	4

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
15	REQUEST WHETHER SETUP IS DEFINED / VALID INPUT IS DETECTED	SETUP # or Input #	0 - for checking if setup is defined 1 - for checking if input is valid	8
16	ERROR / BUSY	For invalid / valid input (i.e. OUTPUT byte = 4 or OUTPUT byte = 5), This byte is set as the input #	0 - error 1 - invalid instruction 2 - out of range 3 - machine busy 4 - invalid input 5 - valid input	9, 25
17	RESERVED	- - - -	- - - -	10
18	RESET AUDIO	0	0	1
19	STORE AUDIO STATUS	Set as SETUP #	0 - to store 1 - to delete	2, 3
20	RECALL AUDIO STATUS	Set as SETUP #	0	2, 3
21	SET VIDEO PARAMETER	Equal to input / output number whose video parameter is to be set (0 = all)	Set as parameter value	2, 11, 24
22	SET AUDIO PARAMETER	Equal to input / output number whose gain is to be set (0 = all)	Set as parameter value	2, 11, 24
23	INCREASE / DECREASE VIDEO PARAMETER	Equal to input / output number whose video parameter is to be increased / decreased (0 = all)	0 - increase video gain 1 - decrease video gain 2 - increase contrast 3 - decrease contrast 4 - increase brightness 5 - decrease brightness 6 - increase color 7 - decrease color 8 - increase hue 9 - decrease hue 16 - increase H-phase 17 - decrease H-phase 18 - increase V-position 19 - decrease V-position	24
24	INCREASE / DECREASE AUDIO PARAMETER	Equal to input / output number whose parameter is to be increased / decreased (0 = all)	0 - increase output 1 - decrease output 2 - increase left output 3 - decrease left output 4 - increase right output 5 - decrease right output 6 - increase input 7 - decrease input 8 - increase left input 9 - decrease left input 10 - increase right input 11 - decrease right input	24
25	REQUEST AUDIO PARAMETER	Equal to input / output number whose parameter is requested	0	6, 24
26	REQUEST VIDEO PARAMETER	Equal to input / output number whose video parameter is requested	0	6, 24
30	LOCK FRONT PANEL	0 - Panel unlocked 1 - Panel locked	0	2
31	REQUEST WHETHER PANEL IS LOCKED	0	0	16
32 to 35	RESERVED	- - - -	- - - -	10
40	DIRECT MEMORY SAVE	Memory address	Data	20

INSTRUCTION		DEFINITION FOR SPECIFIC INSTRUCTION		NOTE
#	DESCRIPTION	INPUT	OUTPUT	
42	AUDIO PARAMETER SETTINGS FOR INSTRUCTIONS 22, 24, 25	INPUT Bit: I0 - 0=input; 1=output I1 - Left I2 - Right	0 - Gain 1 - Bass 2 - Treble 3 - Midrange	24
43	VIDEO PARAMETER SETTINGS FOR INSTRUCTIONS 21, 23, 26	1 – Input 2 – Output	0 - video gain 1 - contrast 2 - brightness 3 - color 4 - hue 5 - H-phase 6 - V-position	24
56	CHANGE TO ASCII	0	1 - SVS protocol 2 - Generic protocol	19
57	SET AUTO-SAVE	I3 - no save I4 - auto-save	0	12, 2
58	EXECUTE LOADED DATA	Set as 0, or as SETUP #.	1-Take 2-Cancel	22, 3
59	LOAD VIDEO DATA	Set equal to video input (0 = disconnect) (127 = load SETUP #)	Set equal to video output (0 = to all the outputs) or SETUP #	22, 23
60	LOAD AUDIO DATA	Set equal to audio input (0 = disconnect) (127 = load SETUP #)	Set equal to audio output (0 = to all the outputs) or SETUP #	22, 23
61	IDENTIFY MACHINE	1 - video machine name 2 - audio machine name 3 - video software version 4 - audio software version 5 - RS422 controller name 6 - RS422 controller version 7 - remote control name 8 - remote software version 9 - Protocol 2000 revision	0 - Request first 4 digits 1 - Request first suffix 2 - Request second suffix 3 - Request third suffix 10 - Request first prefix 11 - Request second prefix 12 - Request third prefix	13
62	DEFINE MACHINE	1 - number of inputs 2 - number of outputs 3 - number of setups	1 - for video 2 - for audio 3 - for SDI 4 - for remote panel 5 - for RS-422 controller	14
63	EXTENDED DATA	7 MSBs for INPUT data	7 MSBs for OUTPUT data	20

NOTES on the above table:

NOTE 1 - When the master switcher is reset, (e.g. when it is turned on), the reset code is sent to the PC. If this code is sent to the switchers, it will reset according to the present power-down settings.

NOTE 2 - These are bi-directional definitions. That is, if the switcher receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the HEX code

01	85	88	83

was sent from the PC, then the switcher (machine 3) will switch input 5 to output 8. If the user switched input 1 to output 7 via the front panel keypad, then the switcher will send HEX codes:

41	81	87	83

to the PC.
When the PC sends one of the commands in this group to the switcher, then, if the instruction is valid, the switcher replies by sending to the PC the same four bytes that it was sent (except for the first byte, where the DESTINATION bit is set high).

NOTE 3 - SETUP # 0 is the present setting. SETUP # 1 and higher are the settings saved in the switcher's memory, (i.e. those used for Store and Recall).

NOTE 4 - The reply to a "REQUEST" instruction is as follows: the same instruction and INPUT codes as were sent are returned, and the OUTPUT is assigned the value of the requested parameter. The replies to instructions 10 and 11 are as per the definitions in instructions 7 and 8 respectively. For example, if the present status of machine number 5 is breakaway setting, then the reply to the HEX code

0B	80	80	85

would be HEX codes

4B	80	81	85

NOTE 5 – For the OUTPUT byte set as 6, the VIS source is the input selected using the OUTPUT byte. Similarly, for the OUTPUT byte set as 7, the VIS source is the output selected using the OUTPUT byte. Note also, that on some machines the sync source is not software selectable, but is selected using switches, jumpers, etc!

NOTE 6 – If INPUT is set to 127 for these instructions, then, if the function is defined on this machine, it replies with OUTPUT=1. If the function is not defined, then the machine replies with OUTPUT=0, or with an error (invalid instruction code).

If the INPUT is set to 126 for these instructions, then, if possible, the machine will return the current setting of this function, even for the case that the function is not defined. For example, for a video switcher which always switches during the VIS of input #1, (and its VIS setting cannot be programmed otherwise), the reply to the HEX code

| 0A | FE | 80 | 81 (ie. request VIS setting, with INPUT set as 126$_{dec}$) |

would be HEX codes

| 4A | FE | 81 | 81 (ie. VIS setting = 1, which is defined as VIS from input #1). |

NOTE 7 – Setting OUTPUT to 0 will return the VIS source setting as defined in instruction #7. Setting to 1 will return the input # or output # of the sync source (for the case where the VIS source is set as 6 or as 7 in instruction #7). Setting to 2 returns the vertical sync frequency (0 for no input sync, 50 for PAL, 60 for NTSC, 127 for error).

NOTE 8 - The reply is as in TYPE 3 above, except that here the OUTPUT is assigned with the value 0 if the setup is not defined / no valid input is detected; or 1 if it is defined / valid input is detected.

NOTE 9 - An error code is returned to the PC if an invalid instruction code was sent to the switcher, or if a parameter associated with the instruction is out of range (e.g. trying to save to a setup greater than the highest one, or trying to switch an input or output greater than the highest one defined). This code is also returned to the PC if an RS-232 instruction is sent while the machine is being programmed via the front panel. Reception of this code by the switcher is not valid.

NOTE 10 – This code is reserved for internal use.

NOTE 11 – For machines where the video and / or audio gain is programmable.

NOTE 12 - Under normal conditions, the machine's present status is saved each time a change is made. The "power-down" save (auto-save) may be disabled using this code. Note that whenever the machine is turned on, the auto-save function is set.

NOTE 13 - This is a request to identify the switcher/s in the system. If the OUTPUT is set as 0, and the INPUT is set as 1, 2, 5 or 7, the machine will send its name. The reply is the decimal value of the INPUT and OUTPUT. For example, for a 2216, the reply to the request to send the audio machine name would be (HEX codes):

| | 7D | 96 | 90 | 81 (i.e. 128$_{dec}$+ 22$_{dec}$ for 2nd byte, and 128$_{dec}$+ 16$_{dec}$ for 3rd byte). |

If the request for identification is sent with the INPUT set as 3 or 4, the appropriate machine will send its software version number. Again, the reply would be the decimal value of the INPUT and OUTPUT - the INPUT representing the number in front of the decimal point, and the OUTPUT representing the number after it. For example, for version 3.5, the reply to the request to send the version number would be (HEX codes):

| | 7D | 83 | 85 | 81 (i.e. 128$_{dec}$+ 3$_{dec}$ for 2nd byte, 128$_{dec}$+ 5$_{dec}$ for 3rd byte). |

If the OUTPUT is set as 1, then the ASCII coding of the lettering following the machine's name is sent. For example, for the VS-7588YC, the reply to the request to send the first suffix would be (HEX codes):

| | 7D | D9 | C3 | 81 (i.e. 128$_{dec}$+ ASCII for "Y"; 128$_{dec}$+ ASCII for "C"). |

NOTE 14 - The number of inputs and outputs refers to the specific machine which is being addressed, *not* to the system. For example, if six 16X16 matrices are configured to make a 48X32 system (48 inputs, 32 outputs), the reply to the HEX code

| 3E | 82 | 81 | 82 (ie. request the number of outputs) |

would be HEX codes

| 7E | 82 | 90 | 82 |

ie. 16 outputs

NOTE 15 – When the OVR bit (4th byte) is set, then the "video" commands have universal meaning. For example, instruction 1 (SWITCH VIDEO) will cause all units (including audio, data, etc.) to switch. Similarly, if a machine is in "FOLLOW" mode, it will perform any "video" instruction.

NOTE 16 - The reply to the "REQUEST WHETHER PANEL IS LOCKED" is as in NOTE 4 above, except that here the OUTPUT is assigned with the value 0 if the panel is unlocked, or 1 if it is locked.

NOTE 17 – For clean switching of RGBHV video, the "seamless switching" option may be used. The blanking period for the transition of the RGB sources may be set in steps of 25 milliseconds.
For example, to set for 350ms blanking time (14 steps), send HEX codes

| 07 | 8E | A0 | 81 |

NOTE 18 – Delayed execution allows switching after a delay dictated by RS-232. To do this, the user sends instruction 7 with the "Set for delayed switch" option (64_{dec}) before sending the switch command (instruction 1) or pressing via front panel. The switch is not executed (unless timed-out) until the "Execute delayed switch" code is sent, or the "Set for delayed switch" code is sent again. (The mode is automatically cancelled after implementation of the switch if the "execute" command is used).
For example, to connect input 4 to output 3 after a delay, send HEX codes

07	80	C0	81	(set for delayed switch)
01	84	83	81	(switch code)

then, after the required delay, send HEX codes

07	80	C1	81	(execute delayed switch)

to implement the switch.

NOTE 19 – After this instruction is sent, the unit will respond to the ASCII command set defined by the OUTPUT byte. The ASCII command to operate with the HEX command set must be sent in order to return to working with HEX codes.

NOTE 20 – When data (ie. the INPUT and/or OUTPUT bytes) of more than 7 bits is required, this instruction is sent before sending the instruction needing the additional bits. The data in this intruction then becomes the Most Significant Bits of that next instruction. For example, to set the audio gain (instruction 22) of output 3 to 681_{dec} ($2A9_{hex}$), you would first send HEX codes

3F	80	85	81

and then send HEX codes

16	83	A9	81.

To set the audio gain of output 6 to 10013_{dec} ($271D_{hex}$), first send HEX codes

3F	80	CE	81

followed by HEX codes

16	86	9D	81.

NOTE 21 – To store data in the non-volatile memory of the unit, eg. the EEPROM for saving SETUPS. The EEPROM address is sent using the INPUT byte, and the data to be stored is sent using the OUTPUT byte. To use this instruction, it is necessary to understand the memory map, and memory structure of the particular machine.

NOTE 22 – Instruction 59 and instruction 60 load data for sending to the crosspoint switcher (or for storing in a SETUP), ie. the data is "lined-up" to be executed later. Instruction 58 executes the loaded data.

NOTE 23 – If the INPUT byte is set as 127_{dec}, then the data stored in a SETUP is loaded. The SETUP # is in the OUTPUT byte.

NOTE 24 – Further information needed in instructions 21, 22, 25 and 26, is sent using instruction 42 – which is sent prior to the instruction. For example, to request the audio gain value of right input # 9, send hex codes

2A	84	80	81

and then send hex codes

19	89	81	81.

NOTE 25 – For units which detect the validity of the video inputs, Instruction 16 will be sent whenever the unit detects a change in the state of an input (in real-time).
For example, if input 3 is detected as invalid, the unit will send the HEX codes

10	83	84	81

If input 7 is detected as valid, then the unit will send HEX codes

10	87	85	81.

LIMITED WARRANTY

Kramer Electronics (hereafter *Kramer*) warrants this product free from defects in material and workmanship under the following terms.

HOW LONG IS THE WARRANTY

Labor and parts are warranted for seven years from the date of the first customer purchase.

WHO IS PROTECTED?

Only the first purchase customer may enforce this warranty.

WHAT IS COVERED AND WHAT IS NOT COVERED

Except as below, this warranty covers all defects in material or workmanship in this product. The following are not covered by the warranty:

1. Any product which is not distributed by Kramer, or which is not purchased from an authorized Kramer dealer. If you are uncertain as to whether a dealer is authorized, please contact Kramer at one of the agents listed in the Web site www.kramerelectronics.com.
2. Any product, on which the serial number has been defaced, modified or removed.
3. Damage, deterioration or malfunction resulting from:
   i) Accident, misuse, abuse, neglect, fire, water, lightning or other acts of nature
   ii) Product modification, or failure to follow instructions supplied with the product
   iii) Repair or attempted repair by anyone not authorized by Kramer
   iv) Any shipment of the product (claims must be presented to the carrier)
   v) Removal or installation of the product
   vi) Any other cause, which does not relate to a product defect
   vii) Cartons, equipment enclosures, cables or accessories used in conjunction with the product

WHAT WE WILL PAY FOR AND WHAT WE WILL NOT PAY FOR

We will pay labor and material expenses for covered items. We will not pay for the following:

1. Removal or installations charges.
2. Costs of initial technical adjustments (set-up), including adjustment of user controls or programming. These costs are the responsibility of the Kramer dealer from whom the product was purchased.
3. Shipping charges.

HOW YOU CAN GET WARRANTY SERVICE

1. To obtain service on you product, you must take or ship it prepaid to any authorized Kramer service center.
2. Whenever warranty service is required, the original dated invoice (or a copy) must be presented as proof of warranty coverage, and should be included in any shipment of the product. Please also include in any mailing a contact name, company, address, and a description of the problem(s).
3. For the name of the nearest Kramer authorized service center, consult your authorized dealer.

LIMITATION OF IMPLIED WARRANTIES

All implied warranties, including warranties of merchantability and fitness for a particular purpose, are limited in duration to the length of this warranty.

EXCLUSION OF DAMAGES

The liability of Kramer for any effective products is limited to the repair or replacement of the product at our option. Kramer shall not be liable for:

1. Damage to other property caused by defects in this product, damages based upon inconvenience, loss of use of the product, loss of time, commercial loss; or:
2. Any other damages, whether incidental, consequential or otherwise. Some countries may not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations and exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from place to place.

NOTE: All products returned to Kramer for service must have prior approval. This may be obtained from your dealer.

This equipment has been tested to determine compliance with the requirements of:

EN-50081:	"Electromagnetic compatibility (EMC);
	generic emission standard.
	Part 1: Residential, commercial and light industry"
EN-50082:	"Electromagnetic compatibility (EMC) generic immunity standard.
	Part 1: Residential, commercial and light industry environment".
CFR-47:	FCC Rules and Regulations:
	Part 15: "Radio frequency devices
	Subpart B – Unintentional radiators"

CAUTION!

⊠ Servicing the machines can only be done by an authorized Kramer technician. Any user who makes changes or modifications to the unit without the expressed approval of the manufacturer will void user authority to operate the equipment.
⊠ Use the supplied DC power supply to feed power to the machine.
⊠ Please use recommended interconnection cables to connect the machine to other components.

For the latest information on our products and a list of Kramer distributors, visit our Web site: www.kramerelectronics.com, where updates to this user manual may be found. We welcome your questions, comments and feedback.

⚠ **Caution**	**Safety Warning**: Disconnect the unit from the power supply before opening/servicing.

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